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BRIEFING

PLASTIC POLLUTION
Bans vs. Recycling Solutions

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INTRODUCTION

Plastic foam (polystyrene) is one of the most widely used plastics around the world.[1] Americans encounter polystyrene products on a daily basis as a low-cost, moldable, synthetic polymer used to create components for automobiles and household appliances like refrigerators and microwaves, as well as DVD cases, plastic utensils, disposable razors, and numerous other consumer products. Polystyrene also can be converted into expanded polystyrene (EPS)—commonly known as Styrofoam®—which, in addition to being inexpensive, is lightweight and a good insulator. As such, it is often used for food and beverage containers, product packaging, and shipping materials. When EPS is used to create food-service products, it is frequently referred to as food-service foam.

Recently, lawmakers and environmental groups have targeted EPS because of its purported environmental impacts. EPS decomposes slowly.[2] Wind can blow the lightweight material out of trash cans or landfills into surrounding areas. EPS that ends up in the ocean can contribute to plastic pollution and the degradation of marine wildlife habitats.

In an attempt to mitigate EPS pollution, some municipalities have banned the use of EPS by restaurants and grocery stores. As cities implement or consider implementing bans on EPS products, it is crucial to understand the options available for dealing with EPS and the tradeoffs associated with these options.

This paper examines:

- How EPS is recycled
- Current and potential bans of EPS products
- Negative effects of EPS bans, including impacts on environment and on minorities
- Potential solutions to EPS pollution

We conclude that while EPS can have serious environmental impacts, the negative economic and environmental effects associated with banning EPS are so great that municipalities should instead adopt alternatives that resolve such problems cost-effectively.

RECYCLING PLASTIC FOAM

One of the main solutions municipalities have explored for mitigating the environmental impact of EPS is recycling. However, recycling EPS presents several challenges distinct from other kinds of plastics (plastic bags, water bottles, and other plastic containers, like milk jugs). These challenges are one major reason many cities choose to ban some EPS products outright.

The same properties that make EPS ideal for shipping and packaging also make it difficult to collect and process for recycling. Curbside collection is problematic because the material can be blown around easily even by a slight breeze. EPS also is difficult to transport in large quantities because, in terms of mass, a small amount of EPS takes up quite a bit of space—the ratio of weight to volume is very

low. EPS thus must be condensed for shipping to recycling centers, which adds extra time and cost to the recycling process. Some recyclers have addressed that problem by using mechanical densifiers (similar to trash compactors) to compress EPS for shipping. In addition to transport problems, EPS is hard to sort because it frequently is contaminated by food and mixed with other kinds of plastic. EPS recyclers must sort clean containers from soiled containers, then wash and dry the soiled containers before they can be recycled.[3] Few municipalities accept foamed polystyrene products for recycling because the recycling process is too costly.

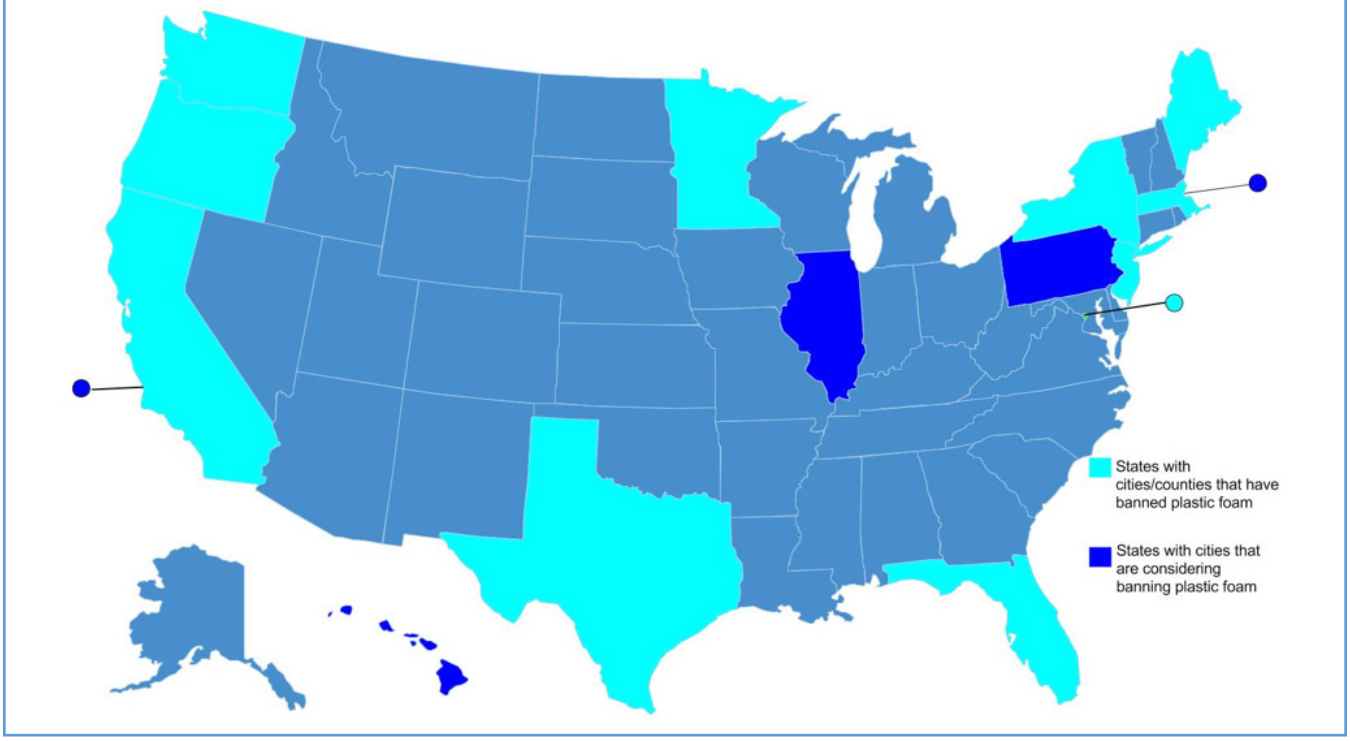
While challenging to process, a number of options nevertheless are available for recycling EPS. Many people reuse EPS products, for example, hoping to reduce their environmental impacts. Shipping companies sometimes accept returns of packing peanuts and other foamed plastic packaging materials. Some recyclers will accept contaminated packaging and clean it before recycling. Clean EPS typically is either shredded to be reused as ceiling insulation or packing peanuts or is melted down and turned into pellets used to create harder plastic items, like toys or faux wood and metal. EPS also can be burned to generate heat that can be harnessed for energy, but that is not a common recycling method at present. [4]

OVERVIEW OF PLASTIC FOAM REGULATIONS

No federal regulations regarding EPS production or disposal have been issued. However, the National Environmental Policy Act (NEPA) does require the Environmental Protection Agency (EPA) or the Food and Drug Administration (FDA) to evaluate packaging materials' environmental impacts. The FDA, in particular, determines whether material used for food packaging can safely be recycled.[5] As EPS is 100 percent recyclable, it passes the FDA's environmental assessment.[6] Despite being safe to recycle, however, only a few states have implemented recycling programs for EPS. Some EPS products simply are too difficult to recycle with currently available technologies.

On average, 2.3 million tons of EPS end up in landfills each year in the United States.[7] That is fewer than 7 percent of the nearly 33.54 million tons of plastic disposed of every year. To reduce the amount of EPS that ends up in landfills, more than a hundred U.S. cities and counties in eleven states have adopted local ordinances that restrict or ban outright the use of foam containers, utensils, and packaging materials.[8] Such ordinances were put in place as early as 1989, with Sonoma, California, and

Figure 1. Map of EPS bans across the United States[10]



Carmel, California, being the first two cities to ban plastic foam containers.[9]

The EPS bans in effect, as of 2015, are shown in Figure 1.

More recently, a number of large cities have taken steps to eliminate EPS from their refuse streams. In 2007, San Francisco banned EPS takeout food containers and initiated a mandatory composting ordinance.[11] Since then, San Franciscans have seen fees for municipal garbage pickup decline.[12] As of June 28, 2016, San Francisco passed what was, at the time, the most far-reaching EPS ban in the country, which included packing peanuts, ice chests, dock floats, and even food-packaging products.[13]

Seattle is another large city that effectively has banned EPS. It did so by introducing the restrictions in stages: Foam products were banned on January 1, 2009, non-compostable disposable food packaging was banned by July 1, 2010, and all plastic utensils and straws are to be banned by July 1, 2018.[14] The slower, staged implementation of the ban allowed companies to more easily find alternatives to EPS.

In January of 2015, New York became the largest city to ban food-service foam products on the grounds that recycling the material was not economically feasible.[15] Shortly thereafter, the city was sued by a coalition comprised of Dart Container Corporation (a major manufacturer of EPS goods), recyclers, the Restaurant Action Alliance NYC (a group of advocates for EPS recycling, but opposed to food-service foam bans), and many local restaurant owners.[16] The plaintiffs argued that because all EPS is recyclable and Dart, other manufacturers, and some recyclers had offered to manage and fund the city's EPS recycling system, the ban should not be implemented. New York Supreme Court judge Margaret Chan agreed with the manufacturers, and the city rescinded the ban.[17] However, Dart offered only to purchase the equipment initially required to recycle the foam and to pay for the recycling "for at least five years."[18] In May of 2017, New York City reimposed the ban, citing the City of New York Department of Sanitation's conclusion that food-service foam "cannot be recycled in a manner that is economically feasible or environmentally effective"; the ban stated that as soon as Dart stopped paying for the recycling, private recyclers in the area would need to shut down.[19] By September 12, the same coalition was suing the city again.[20]

While New York City struggled through the court system, San Diego sought a different solution. Instead of imposing a ban citywide, San Diego began implementing a recycling program effective July 1, 2017.[21] The plan allows single-family households to recycle food and beverage containers in addition to EPS shipping materials. San Diego receives $3.3 million annually in revenue from its recycling programs paid by citizens, $90,000 of which it will use to implement the new program.[22]

California legislators have attempted but failed to implement statewide bans on EPS multiple times. The most recent attempt was in January of 2018.[23] In February of 2018, state legislators instead introduced an alternative to banning EPS. That alternative calls for the creation of a Polystyrene Food Service Packaging Recycling Organization, which would be made up of all the manufacturers of food-service polystyrene in the state. The organization would then pay a fee (essentially a tax) that would be earmarked to pay for the recycling of EPS and help promote programs to expand recycling or reduce litter from EPS.[24] Earmarking taxes, however, is no guarantee that the funds raised for the recycling program will actually be used for that program. Earmarking funds does not prevent politicians from raiding them to cover budget shortfalls elsewhere.[25]

The earmarked tax issue should be readily apparent to anyone who has ever driven a car in California, where federal and state taxes account for 20 percent of the cost of gasoline at the pump. The money raised by the state's gas tax is "earmarked" for road repairs and improvements. From 2007 to 2010, however, $1.3 billion in transportation funds were used to fill public spending holes rather than potholes.[26] The city of San Bernardino re-appropriated so much money from gas tax funds in 2012–2013 that not enough was left to fund projects listed in the city's capital improvement plan.[27] The new proposal to tax food-service polystyrene manufacturers could very well leave them on the hook to fund far more than a recycling program, with no guarantee that enough money will be collected to fully fund the program itself.

Hawaii may be the first to impose a statewide EPS ban. Currently, both Maui and the Big Island have instituted bans that are effective at the end of 2018 and in mid-2019, respectively.[28] A bill also is moving through Hawaii's legislature that would ban EPS statewide.[29]

Australia, one of the world's leaders in innovative recycling, is a prime example of using an alternative method for removing EPS from the marketplace. EPSA (Expanded Polystyrene Australia) is a company that specializes in EPS recycling and has established a number of facilities, called the REPSA National Collection Network, to help enhance EPS recycling. From 2009 to 2010, EPSA recycled more than 3,000 tons of EPS.[30] In addition to the already existing recycling opportunities, Australian cities are phasing out EPS use. Hobart, a city in Tasmania, is phasing out foam containers by 2020 and replacing them with ones made of cardboard, cornstarch, and bamboo. Eventually, even biodegradable plastic will be phased out.[31] Local government officials there believe that EPS lacks a recycling market and that if a viable option is offered, most people will turn to it.[32]

Such bans and recycling programs all have costs associated with them, each of which should be considered before implementation. The effects of high levels of consumer consumption of EPS may pose environmental risks, but the implementation of bans also comes with high economic costs and serious environmental implications.

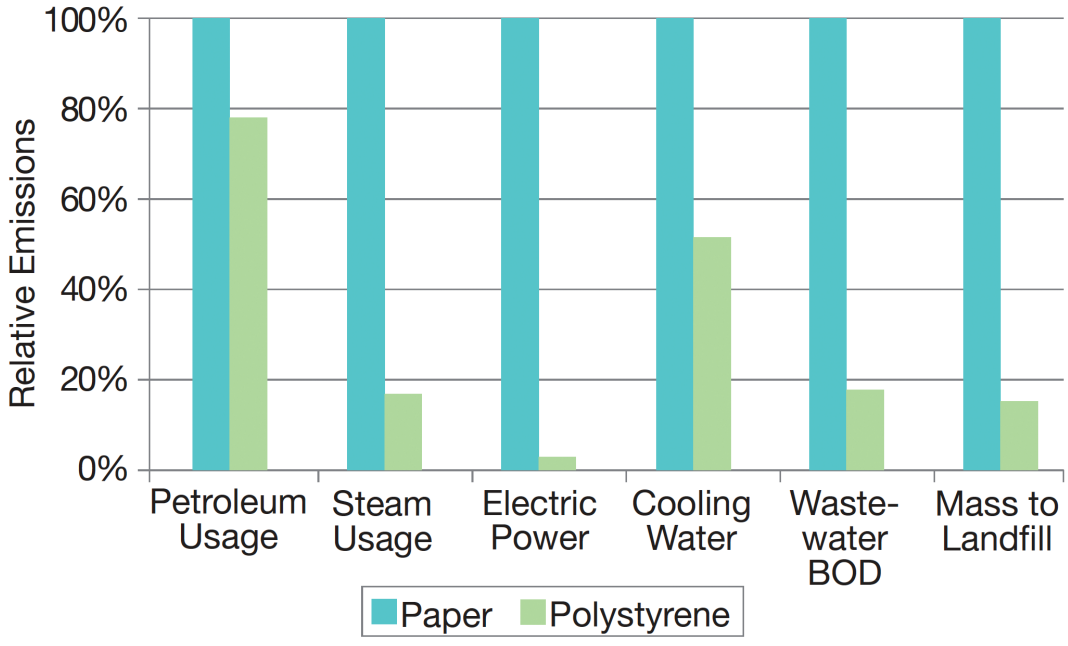
EFFECTS OF BANS

Impact on Businesses and Consumers

EPS bans have widespread impacts on businesses and individual consumers. EPS is inexpensive, lightweight, and an effective insulator. Small restaurants and food vendors, therefore, prefer it to other materials. In 2014, New York City collected an estimated 28,500 tons of EPS, about 90 percent of which came from single-use containers handed out to the customers of food vendors and restaurants.[33] Small businesses—many minority-owned[34]—also frequently use packing peanuts made of EPS for their shipping needs. EPS bans affect industries that are less able to absorb the costs of switching to more environmentally friendly materials: small businesses often operate on thin profit margins.[35] Such bans are regressive as they represent the preferences of the wealthy and burden the poor proportionately more in the form of higher prices and lower wages in businesses they impact.[36] In a study of the effects of New York City's EPS ban, for every $1 currently spent on EPS containers, businesses will have to spend at least $1.94 for any alternative material now available.[37]

In addition to the impact that EPS bans have on retailers, the cost to manufacturers of EPS is significant. Based on multipliers calculated by Keybridge Research, the direct and indirect impacts of the ban on EPS manufacturing in New York City could eliminate 2,000 jobs and $400 million in economic activity.[38] In California, an estimated 8,000 jobs would disappear.[39]

Figure 2. The Life-cycle Inventory Compares Disposable Paper Cups to Polystyrene Foam[45]



Effects on the Environment

Despite the best intentions of policymakers, EPS bans actually can have negative impacts on the environment. Paper alternatives to EPS often create more waste (by volume and energy use) and cause more air and water pollution.[40] Paper manufacturing, for instance, has significantly more of an environmental impact than foam manufacturing (see Figure 2). The American Chemical Council found that a 16-ounce EPS cup is more environmentally friendly than a paper cup of the same size that comes with a corrugated cardboard sleeve; otherwise, they are roughly equivalent in terms of the pollution they generate.[41] A study in San Francisco found that from 2007 to 2008, the year the city implemented an EPS ban, "polystyrene foam food and drink containers do not constitute a significant component of litter and that prohibiting the sale and use of polystyrene cups does not decrease overall litter but causes a shift in litter to other materials."[42] Many of the biodegradable plastics that are offered as alternatives to EPS are even more difficult to recycle.[43] The California State Water Resources Control Board released a study stating that "mere substitution would not result in reduced trash generation if such product substitution would be discarded in the same manner as the banned item."[44]

Bans on EPS do have a positive side: the short-term effect of bans can reduce plastic waste and possibly encourage innovation to develop better "green" food packaging. Currently, "green" food packages are 30 cents more expensive than foam containers.[46] Biodegradable plastics, one common type of "green" food packaging, require specific conditions to decompose. Such conditions aren't found in nature, and therefore recycling plants are needed. Only 113 recycling plants exist nationwide that can compost this material, and only around 28 of those accept municipal food scraps.[47] So while "green" food packaging has become cheaper and more available over the years, it still isn't a feasible alternative to EPS. Innovation in alternative materials may eventually lead to replacements for EPS which are less costly and better for the environment. Until then, however, bans are only forcing individuals to adopt costlier and less environmentally friendly products to replace EPS.

Implementation Costs

Both banning and recycling EPS can be expensive. According to the California Department of Conservation, it costs $3,000 per ton to recycle EPS. That means that it costs more to recycle EPS than its value as scrap.[48] Referring again to San Diego, the city's EPS recycling program originally cost $300,000, but with the addition of a secondary processor to sort and recycle EPS, the program will cost only $90,000 per year. That is a significant part of the city's $3.3 million annual recycling revenue from citizens, but not as much as it could have been.[49] Although it is costly and perhaps not economically feasible to recycle EPS in some places, banning it can be even more costly.

According to a study of New York City's proposed food-service foam ban, the minimum total direct cost of implementing a plastic foam ban citywide would amount to $91.3 million. The estimated average increase in cost to switch from food-service foam to an alternative material is 87.1 percent for food-service vendors (see Table 2). That cost calculation is based on the assumption that vendors will substitute the cheapest alternative to EPS, not necessarily the most effective one. To actually achieve the same level of efficiency as EPS, New York City consumers, businesses, and agencies will face an average increased cost of 94 percent, meaning that for every $1 spent on foam containers, $1.94 will be spent on the best alternative. Effectively, that's a 94-cent tax added to food products to satisfy the environmental desires of legislators.[50] The direct cost of EPS bans likely is even higher than that estimate. The lowest-cost alternative that is used for the estimates is not as effective in rigidity, insulation, reliability, and sanitation as EPS and, thus, business owners may pursue higher-cost alternatives in order to retain the same customer-experience quality that EPS products now deliver.[51] In New York City, the ban could cost municipal agencies providing food services $11.2 million, in addition to possible losses from private business tax income ranging from $3.3 million to $7.4 million. The impact on the public schools and other city agencies alone could be as high as $18.6 million.[52]

In California, banning EPS would reduce overall output by an estimated $1.4 billion and raise annual consumer spending on disposable food-service products by roughly $376 million.[53] In Oakland, California, food vendors are encouraged to pass the increase in costs on to customers by adding a "takeout fee" to retail prices.[54] As inefficient and costly as recycling is, it may still be a better option than banning foam products altogether.

Table 1 shows the costs of the proposed New York City ban by business sector. The total cost for businesses and industries to switch away from foam would cost an estimated $91.3 million. Table 2 shows the average price increase, as well as a price comparison, associated with substituting other materials for EPS. The total percentage price increase from switching to the least costly alternative is 87.1%. The two tables together show the economic impact that an EPS ban would have per industry by forcing businesses to use alternatives to plastic foam.

Table 1. Costs of a Plastic Foam Foodservice & Drink Containers Ban in NYC, 2012 ($millions)[55]

Borough	Full-Service Restaurants	Limited-Service Restaurants	Grocery Stores/ Wholesalers	Convenience Stores	NYC Agencies	Total
Bronx	$0.40	$3.00	$0.40	$0.20	$3.60	$7.60
Brooklyn	$1.50	$4.80	$0.80	$0.40	$6.50	$14.00
Manhattan	$17.00	$21.00	$0.50	$0.40	$4.10	$43.10
Queens	$1.40	$7.40	$0.70	$0.60	$5.80	$15.80
Staten Island	$0.30	$0.90	$0.10	$0.20	$1.20	$2.70
School Trays					$8.10	$8.10
NYC Total	$20.60	$37.10	$2.50	$1.80	$29.30	$91.30

Table 2. Cost Premium for Plastic Foam Food-Service and Drink Container Alternatives ($ per unit)[56]

	Plastic Foam	Fiber w/ Sleeve	Plastic	PLA w/ Sleeve[a]	Cost Difference for Least Costly Alternative	Percent Increase
Average, Clamshells	$0.08	$0.20	$0.17	$0.41	$108.70	75.75%
Average, Cups	$0.03	$0.11	$0.03	$0.20	$0.02	89.98%
Average, Plates & Bowls	$0.02	$0.04	$0.07	$0.11	$0.01	55.86%
Overall Average						87.10%

[a]PLA (polylactic acid) is a biodegradable alternative to the plastic lining inside paper cups.

Effect on Innovation of Recycling Solutions

A recent study found that EPS recycling has expanded more quickly than has the recycling of alternative products. Compared to the 15 percent of recycling programs for EPS alternatives, 50 percent of major cities in California now have access to EPS recycling.[57] Bans can stifle innovation and lead to fewer opportunities for recycling. In South Los Angeles, Titus MRF Services is one example of a new company innovating in the recycling market. Titus partners with material recovery facilities to recycle trash again before it heads to the landfill,[58] offering additional opportunities for products like EPS to get recycled. Other companies are innovating to change the process for recycling EPS to make it more economically feasible. For example, Agilyx is a new company that can convert polystyrene all the way back into crude oil if needed. That innovation allows recycled EPS to have many new uses. The bans on EPS in the western states, however, may deplete Agylix's supply of EPS products severely.[59] Banning EPS is economically and environmentally costly and appears to be stifling new and innovative alternative uses for the material.

SOLUTIONS

At its core, pollution caused by EPS is another "tragedy of the commons," a problem caused by the absence of well-defined property rights. No one owns the pollution, and therefore no one has a responsibility to do something about it.[60] That problem is exacerbated by the socialized nature of landfills, beaches, waterways, roads, parks, and other public places, which are managed by numerous government agencies with weak incentives to control the disposal and collection of trash by visitors or drivers. The privatization of such domains largely would end the problem of debris that is dumped or left free to be blown around, including into the ocean, lakes, and streams.

One need only compare Disneyland, for example, with a national park or a public beach to see the environmental benefits of privatization.

EPS producers themselves have little incentive to invest in recycling technologies, since creating new EPS is cheaper than recycling it. Foam takeout packaging is cheaper than most paper alternatives, making it appealing to food vendors (particularly small vendors).[61] Governments that already manage waste disposal have some incentive to try to control the problem, but they may not be best equipped to do so, or the most efficient at handling the problem. As mentioned above, blanket bans of EPS products in food service can generate economic and environmental costs, and thus it may not be an effective solution to pollution.

Private Action

Private recyclers and companies have made progress in reducing the impact of EPS pollution. Some private companies are making decisions to move away from EPS of their own accord. Other private companies are looking at making recycling more efficient and more accessible.

Several large retail companies—Dunkin' Donuts, Target, McDonald's, Crate and Barrel, and others—have announced or implemented plans to phase out EPS packaging in favor of paper and more easily recyclable plastic options. Dunkin' Donuts says that the shift is "part of its commitment to serve both people and the planet responsibly," which echoes the sentiments of other companies moving away from EPS.[62] Starbucks® recently announced a $10 million grant to encourage development of a new, more environmentally friendly coffee cup.[63] Larger companies that can afford to shift away from EPS products to more expensive alternatives may do so in response to public pressure and in an attempt to be better corporate citizens. If local governments are intent on implementing EPS bans, they would do better to focus on large companies that can afford to make the change, rather than small, local businesses that get hit hard by EPS bans.

Other private groups are working to advance EPS recycling efforts. Since most municipal recyclers do not recycle EPS, most of the material ends up in landfills or wherever the wind takes it. Some private companies will pick up used, clean EPS and recycle it for a small price. Unfortunately, most of those recyclers accept only uncontaminated EPS and, even then, frequently operate at a loss. Sedona Recycles, a nonprofit recycler in Sedona, Arizona, says that recycling EPS costs them $725.85 per pallet.[64] They continue to recycle, using donations, and try to reduce EPS pollution with every pallet they process.

The New York City and Dart Container Corporation example from above illustrates that while it may be beneficial for container manufacturers to subsidize food-service foam recycling indefinitely, without sponsorship, recycling contaminated EPS products will remain economically unfeasible without new innovation.

However, by banning the use of EPS products, lawmakers may unintentionally slow the development of new recycling technologies. EPS is a valuable resource that makes many people's lives better in small ways. It may be worthwhile to incentivize more recycling and allow small business owners to continue using food-service foam, rather than forcing them to bear the cost burden of EPS regulations.

Alternatives to Bans

By banning food-service foam, local governments force small business owners to incur the cost of reducing EPS pollution. Local governments might do better to first reduce the use of the product in public organizations and then incentivize businesses to stop using the product, rather than punishing them.

Many bans on EPS food-service products exclude government services, like soup kitchens and public schools. The governments that impose such bans acknowledge that they are costly for the people that use food-service foam, but rather than internalizing the cost, governments force other people and businesses to bear it. When trying to reduce the effect of EPS pollution, local governments would be wise to start from the inside.

In addition, it might be more effective (albeit costlier) for local governments to incentivize small businesses to stop using food-service foam, rather than forcing them to stop. That could be done by offering a small tax break, paying businesses the difference between EPS products and paper or other plastic products, or by implementing some sort of citywide rewards program for businesses that switch to more eco-friendly products. Bans may be the most straightforward option, but local governments could increase overall welfare by finding alternatives to banning EPS products. Such alternatives are only a few suggestions for creating more equitable policies.

CONCLUSION

Plastic pollution is a global problem. In 2010, according to the *Wall Street Journal*, "people living within 50 kilometers (30 miles) of the coast . . . generated a total of

275 million metric tons of plastic," of which between 4.8 million and 12.7 million found their way to the world's oceans and waterways.[65] The United States is estimated to have generated nearly 0.3 million metric tons of plastic pollution that year, including between 0.04 million and 0.11 million metric tons that ended up in the seas, making the country the twentieth largest contributor of plastic marine debris. China, by contrast, ranked first, contributing between 1.32 million and 3.53 million metric tons. The main lesson is that poor countries and those without well-developed market institutions (often the same) are the world's biggest plastic polluters.

Simple solutions taken here at home, like banning food-service foam and plastic straws, won't make much of a dent in mismanaged plastic waste. And those solutions impose disproportionate compliance costs on minorities and small business owners.

In addition, such bans have negative environmental impacts, are costly, and can stifle innovation. Rather than taking what seems to be the most straightforward path, regulators should examine the incentives of everyone involved in the EPS supply chain and then adopt other policies to better manage the pollution problem. Local governments and groups that lobby to ban EPS products should consider both the economic and environmental impacts of such bans before proposing or implementing them.

Only 9 percent of the world's plastic is currently recycled,[66] but a newly discovered enzyme promises to take a big bite out of the remaining mountain of discarded water bottles and other plastic containers by enabling items to be "digested" into a more reusable form.[67] Other companies have found ways to make a profit by teaming with material-recovery facilities to recycle trash.[68] Some private companies are moving away from EPS of their own accord.[69] Private-sector entrepreneurship, not government regulation, will eventually solve the plastic-waste problem.

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